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CRITICAL REVIEW

OF THE

POST-MORTEM SIGNS OF DROWNING.

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A CRITICAL REVIEW OF THE POST-MORTEM SIGNS OF DROWNING.

THE frequency with which cases of drowning occur in the practice of medical jurists renders it of importance from time to time to pass under review, in the light of experience, the various post-mortem signs which indicate this form of death.

This paper has as its basis the cases, 170 in number, which have been met with in Aberdeen and its immediate neighbourhood during a number of years. Of these, however, only 130 were examined internally. Many other cases have been omitted for the sake of clearness, where, from advanced decomposition or other causes, the signs of drowning were not well marked, or were mixed with those of other fatal injuries.

The generally-received signs of drowning are shortly these:—

External Signs.—General pallor of the surface of the body, with bright rosy-red patches on the face and front of the neck chiefly, sometimes on other situations. Cutis anserina on the outer aspect of the thighs and arms and about the top of the sternum. A blanched and corrugated condition of the skin of the hands, wrists, feet, and ankles, and not infrequently of the front of the knees and back of the elbows. This state of the hands may be accompanied by what has been termed the “cholera hand,” where venous congestion shining through the bleached cuticle gives the hand a bluish appearance, like that observed in persons suffering from cholera. A white watery froth, like the lather of soap, at the mouth and nostrils, generally found when the body is seen in a fresh state and soon after its removal from the water; or a red bloody froth at these parts when the body is decomposed. Water, sometimes mixed with froth, which flows from the mouth in quantity when the body is turned face downwards. The tongue may be protruded beyond or pressed against and marked by the teeth. The penis may be

erect, semi-erect, or retracted, and the scrotum shrunk and wrinkled. Sand or weeds may be found under the nails, or grasped in the clenched hands. Excoriations are not infrequently observed about the knuckles, or erosions on the hands, face, ears, etc., caused by fish or other animals in the water after death. Injuries of various kinds, cuts, bruises, evidently inflicted before death, which may complicate the diagnosis, may not infrequently be found.

Internal Signs.—Water in the air-passages, lungs, œsophagus, stomach, and watery fluid in the pleural and peritoneal cavities. White watery froth in the mouth, throat, air-passages, and lungs, perhaps also in the stomach. Sand, etc., in these situations. Bulkiness or protrusion of the lungs, and over-distention or rupture of their superficial air-cells. Fluidity of the blood in the heart. Redness of the trachea and gullet. In conjunction with these, the usual signs of asphyxia, namely, more blood in the right than in the left cavities of the heart; congestion of the lungs, liver, spleen, and kidneys; perhaps, also, congestion of the brain and the blood-vessels within the skull.

On considering the *external* signs, we find very little to guide us to a decision as to the cause of death, the only ones which we can utilize being (1) the water which flows, generally in abundance, from the mouth on turning the body face downwards; and (2) the froth at the lips and nostrils. With regard to the former of these, though hitherto little noticed, it would seem to be one of great utility, as, except in the event of the person having drunk largely of water before immersion, it could hardly mislead; and even allowing such a hypothesis, the amount which often pours out is such as no one would have been likely to swallow within a short time; the water, too, may be salt, and perhaps even mixed with sand, seaweed, etc. Though stated at 14·1 per cent. of the cases quoted, it ought really to have been placed in a much higher ratio, since it was only lately that it was noted in our post-mortem records; in the cases, 26 in all, in which it was looked for, it failed in two where decomposition was pretty well advanced.

On the latter, also, much reliance may be placed, as, when the body is seen soon after removal from the water, and if the face has not been wiped, it will seldom fail. We must, however, discriminate between the white and the red froth, for the former is a sign found in fresh bodies, and the latter in those advanced in putrefaction, and is not confined to the bodies of the drowned.

The white froth was seen in 20 per cent. at the lips and in 12·9 per cent. at the nostrils; but, like the first sign, these ratios must be taken with this qualification, that, had the bodies been seen earlier, the froth would probably have been found in nearly every case.

As to the red froth observed at the lips in 4·1 per cent., and at the nostrils in 8·2 per cent., when it is present in any quantity, when on compressing the chest more issues out mixed with water,

and when the bubbles are small, it may have some importance; but, as a rule, it is not to be trusted to *per se*.

These, then, might be classed as so far reliable signs of drowning—that is to say, that when they are found well marked we may be justified in stating that the person had probably been drowned.

The signs which follow, on the other hand, can only be used as strengthening these when they are present. Of those, perhaps the most important is the bleaching and corrugation of the hands and feet (seen in 82·9 per cent.), and of the knees and elbows (in 26·4 per cent.) The objection which has been urged against this sign, that it may be produced by soaking the body in water after death, or even by surrounding the hands, etc., with damp cloths, would hardly weigh much against it, however, unless wounds of a fatal nature coexisted; but any suspicion of poison having been used might be damaging to its value. The above remarks apply with equal strength to the appearance known as the cholera hand, which, besides, occurs too rarely to be of much use. It was seen in only 7 per cent. of the cases.

By some medical jurists it is stated that the pallor of the skin is a marked feature in the bodies of the drowned. It was noted in 39·4 per cent., but this sign has but little value. The skin, especially over the face and front of the chest, is frequently observed to be of a rosy-red colour, sometimes giving the corpse a singularly life-like appearance; but this could hardly be of much value, as it is also observed in other cases—as in death by cold, carbonic oxide poisoning, etc. It may, however, have some little value. It was noted in 52·9 per cent. of the cases. Of considerable value, as indicating that the person has been deprived of life while the circulatory and nervous functions were in full activity, the existence of cutis anserina may assist us in determining that the death had been sudden and unnatural; but as it is also seen in death from other violent causes—such as hanging—we cannot allow it to be a sign of death by drowning in a strict sense. It occurred in 62·3 per cent.

The finding of sand, etc., underneath the nails is of little value except in so far as it may determine the locality where the body got into the water.

The protrusion of the tongue, or its being pressed against and marked by the teeth, is merely a sign common to most forms of death by asphyxia.

With regard to the condition of the penis much dispute has arisen, Caspar having regarded the state of retraction as diagnostic of drowning. But here he is at variance with other medical jurists, who regard semi-erection as the usual state. In the 72 cases where its appearance was noted, semi-erection was found in 58·3 per cent., retraction in 23·6 per cent., and erection in 16·6 per cent. It would appear, then, that semi-erection is the most

usual appearance. The sign, however, seems not to be of much real importance.

The last three appearances noticed in the subjoined table are merely inserted here as showing the ratio in which such injuries may be looked for in a given number of cases, and because they have been brought forward by some authors as occurring in the drowned. They can in no sense, however, be regarded as signs of drowning.

It would thus appear that from a mere view of the body of a person suspected to have been drowned we should hardly be justified in certifying that drowning was the cause of his death, but that we should formulate some such opinion as this—that the signs observed were not incompatible with the supposition that he had died by drowning.

TABLE I.

External Signs of Drowning in 170 Cases.

	Number of times observed.	Ratio per cent.
<i>Special Appearances.</i>		
Water, sometimes frothy, flowing from the mouth on turning the body,	24	14.1
White froth at the lips,	34	20.0
" " nostrils,	22	12.9
Red froth at the lips,	7	4.1
" " nostrils,	14	8.2
<i>Auxiliary Appearances.</i>		
Bleaching, etc., of the hands and feet,	141	82.9
" " knees and elbows,	45	26.4
Cholera hand,	12	7.0
Pallor of surface of the body,	67	39.4
Rosy patches,	90	52.9
Cutis anserina,	106	62.3
Sand under nails,	5	2.9
Protrusion, etc., of tongue,	29	17.0
Erection of the penis, { in 72 cases }	13	16.6
Semi-erection " { where it was }	42	58.3
Retraction " { noted. }	17	23.6
<i>Occasional Appearances.</i>		
Excoriations on prominent parts,	16	9.4
Erosions (post-mortem).	31	18.2
Injuries (various, ante-mortem),	10	5.8

In studying the *internal* signs of drowning, while trusting again to the presence of water and froth in the body as our chief indication, we are assisted by the occasional presence in the respiratory tract of foreign substances, such as sand, seaweed,

etc.; by the fluidity of the blood; and by the usual signs of asphyxia.

We have to look primarily for water in the respiratory tract; secondarily, in those cavities bordering on the lungs, especially when the body has lain in water for some time; and, thirdly, in the digestive tract or its surrounding cavities.

Since water is drawn into the body with each attempt at inspiration, we naturally expect to find it in the air-passages and lungs. In the former it was found in 65·3 per cent., and in the latter in 77·6 per cent. In the pleural and pericardial cavities it occurred in notable quantity in 48 and 16·9 per cent. respectively, the fluid being sometimes almost colourless water, sometimes bloody, but always unmistakably the product of exosmosis from the cedematous lungs.

Since we know that drowning persons swallow water, which fills the mouth in the act of inspiration under water, we look with confidence for it in the œsophagus and stomach to assist our diagnosis. It was observed in the œsophagus in 14·6 per cent., and in the stomach in 74·6 per cent. of the cases; while in bodies examined after a prolonged stay in water it was found in the peritoneal cavity in 12·3 per cent., having soaked through the walls of the stomach.

From the presence of white, watery froth in abundant quantity in the air-passages and lungs, and in a minor degree in the œsophagus and stomach, we derive much trustworthy information second only to that conveyed by the presence of water in these situations. This froth was found in the air-passages in 66·9 per cent.; in the minute bronchi and air-cells of the lungs in 15·3 per cent.; in the mouth in 18·4 per cent.; in the œsophagus in 15·3 per cent.; and in the stomach in 3 per cent. of the bodies inspected.

A note of caution is here necessary with regard to the froth in the drowned, as many of our writers on legal medicine have fallen into the unpardonable error of describing it as *mucous froth*. A very slight examination will suffice to dissipate this error. On taking a little upon the point of the knife and touching the bubbles with a needle, they may be easily made to collapse, leaving only watery fluid, while if any trace of mucus were present it would then betray itself by the stringy residue which would be found along with the water. This has been repeatedly demonstrated in the presence of colleagues and students at the post-mortem examination of bodies of drowned persons.

It may be objected that froth in the lungs is found in bodies of those who have died otherwise than by drowning, and that this is true cannot be denied, as in cases of acute cedema of the lungs, and also in those of children who have died by smothering, this froth—*i.e.*, white watery froth—is a prominent appearance; but on closer examination this objection falls to the ground, as it

is never found in such a great quantity in any form of death as in that by drowning, in the former cases the froth *oozing* out of the small and large bronchi, in the latter *pouring* out from every cut surface of the lungs.

When foreign substances, sand, seaweed, etc., are found along with water and froth in the air-passages and lungs, they serve to strengthen these proofs, especially when they are compared with the products of the locality in which the corpse is found. They rarely occur, however (see Table II.)

As a curiosity, it has been noted that white froth (in 3.8 per cent.) and sand (in 0.7 per cent.) were met with in the pleural cavities. These had evidently escaped from ruptured superficial air-cells of the lungs.

To over-distention and perhaps rupture of the superficial air-cells of the lungs have been assigned a certain value; but apart from the more important œdema they have slight significance, though taken in conjunction with it they may be of a little assistance. The former was noted in 7.6 and the latter in 4.6 of the cases.

The same remarks apply to the two signs next in order in Table II., namely, bulkiness and protrusion of the lungs, which are seen on removing the sternum. Bulkiness was noticed in 31.6, and protrusion in 6.9 per cent. It should be said, however, that when the lungs protruded from the chest on its being opened, water or watery fluid in some, often great, quantity was found in the pleural cavities, and that the protrusion was caused by the still buoyant lungs floating on its surface when the controlling pressure of the sternum was removed.

As a sign of somewhat doubtful trustworthiness, the entire fluidity of the blood in the heart has been much discussed. This was encountered in 55.3 per cent. of the inspections; while dark loose clots were seen in 27.6, and yellow (fibrinous) clots in 3 per cent. Thus it would seem that a certain amount of confidence may be reposed on this appearance, and that we should not be justified in neglecting it altogether.

Since, in the great majority of instances, persons who are drowned die by asphyxia, we naturally expect to find the appearances proper to this mode of death in the bodies of those we examine. Of these, engorgement of the right heart was noted in 79.2 per cent., congestion of the lungs in 81.5 per cent., and of the liver, spleen, and kidneys in 82.3 per cent. of the cases inspected. These signs, however, can only be regarded as auxiliary factors which, in conjunction with the special signs, may aid our conclusions.

Redness of the trachea and gullet may be included among the signs of asphyxia, though some medical jurists have been inclined to class it as a special sign of drowning. It is of slight value under whichever category it is placed. It was noted in the trachea

in only 18·4 per cent., and in the gullet in 5·3 per cent. It is perhaps hardly necessary to state that this redness is distinct from that of hypostasis in being found in the non-dependent as well as the dependent parts of these tubes.

While in the majority of instances the signs of asphyxia are, or have been, assumed to be the most striking appearances in the drowned, those of syncope are not of very rare occurrence, while those of coma would seem to be observable oftener than many authors allow. Thus the blood was found in equal quantity in the lateral cavities of the heart in 13 per cent. of the cases—a most characteristic sign of syncope,—as also pallor of the brain and meninges in 4·6 per cent.; while, on the other hand, well-marked congestion of the brain and the bloodvessels of its membranes was found in 55·3 per cent. of the cases—a sign met with in death by coma. In such cases, however, these appearances were frequently mixed with those of asphyxia to a greater or less degree.

I must, however, guard myself against the assumption of regarding this meningeal and cerebral congestion as a sign purely applicable to death by coma, for in many cases, perhaps the majority, of death by smothering in infants, where the appearances of asphyxia in the lungs, liver, etc., are well marked, we find also unmistakable congestion of the brain and the bloodvessels of the head. This is a fact which appears to require further elucidation, the statement frequently made that infants in most cases die in a convulsion being an assertion, not the explanation of a phenomenon.

Taken in conjunction with this congestion within the head, what is perhaps a further development of the same condition was met with in 7·6 of the cases, namely a layer of clotted blood more or less thick on the inner surface of the scalp.

As against Tardieu's opinion that punctiform ecchymoses are a reliable sign of death by smothering, it has been urged that these are not infrequently seen in other forms of death. This is so far true, as may be seen in the subjoined table (II.), but they are the exception and not the rule, as they are in smothering; and besides, as has been shown by my father in his *Lectures on Medical Jurisprudence*, they are few, not grouped, and comparatively large in drowning, hanging, etc., while in smothering they are numerous, grouped, and almost invariably very minute, often looking as if the lung had been dusted with cayenne pepper.

As assisting somewhat in the determination of the suicidal or accidental nature of the drowning, and as also in some measure helping to account for the congestion within the head, the odour of alcohol sometimes observed within the body is interesting. Alcoholic odours were distinctly perceived in the fluids within the skull in 7·6 per cent., the heart in 0·7 per cent., and the stomach in 3 per cent.

TABLE II.

	Number of times observed.	Ratio per cent.
<i>Special Appearances.</i>		
Water in the air-passages,	85	65.3
" minute bronchi and air-cells of lungs, .	101	77.6
" œsophagus,	19	14.6
" stomach,	97	74.6
" pleural cavities,	63	48.0
" pericardium,	22	16.9
" peritoneal cavity,	16	12.3
White watery froth in the mouth,	24	18.4
" " air-passages,	87	66.9
" " minute bronchi and air-cells of the lungs,	21	15.3
" " œsophagus,	21	15.3
" " stomach,	4	3.0
" " pleural cavities,	5	3.8
Sand in the air-passages,	10	7.6
" minute bronchi and air-cells of the lungs, .	2	1.6
" œsophagus,	1	0.7
" stomach,	2	1.6
" pleural cavities,	1	0.7
Sea-weed in the larynx,	1	0.7
" month,	1	0.7
Over-distention of the superficial air-cells of the lungs, .	10	7.6
Rupture " " " " " " " "	6	4.6
Bulkiness of the lungs,	48	31.6
Protrusion " " " " " " " "	9	6.9
Entire fluidity of blood in the heart,	72	55.3
Partially clotted state " " " " " " " "	36	27.6
Yellow (fibrinous) blood-clot " " " " " " " "	4	3.0
<i>Auxiliary Appearances.</i>		
Blood in greatest amount in right heart,	103	79.2
" equal quantity in each side of the heart,	17	13.0
Congestion of the lungs,	106	81.5
" liver, spleen, and kidneys,	107	82.3
Redness of the trachea,	24	18.4
" gullet,	7	5.3
Congestion of the brain and its bloodvessels,	72	55.3
Pallor of the brain,	6	4.6
<i>Occasional Appearances.</i>		
A layer of clotted blood under the scalp,	10	7.6
Punctiform ecchymoses, " " " " " " " "	7	5.3
" " under the pleural covering of the lungs,	9	6.9
" " on the surface of the heart,	3	2.3
" " " " " " " " spleen,	2	1.6
" " " " " " " " kidneys,	1	0.7
Alcoholic odour of the blood in the brain,	10	7.6
" " heart,	1	0.7
" " stomach,	4	3.0

The conclusions derivable from all this would seem to be that—

1. When an external examination of the body only is allowed, if abundance of water pours from the mouth on turning the corpse face downwards, and if white watery froth is found at the mouth and nostrils, or if it may be made to issue from them on compressing the chest, we may be justified in giving an opinion as to the probability of drowning, especially when the accessory signs, viz., rosy redness of the face and front of the chest, gooseskin, and bleaching and corrugation of the hands, are well marked, presuming always that no lethal injuries are seen on the body which would appear to have been inflicted before death, and no traces of corrosive action, etc., from poisons be observable about the lips, hands, clothes, etc.; but that to justify us in giving a more positive opinion we ought to have furnished to us a detailed account of the locality in which, and the circumstances under which the body was observed before its removal to the place where it lies for examination.

2. That where a complete inspection of the body is permitted, we may give a more positive opinion when, in addition to the external appearances, water in marked quantity, mixed with white watery froth, is found in the lungs and stomach, and also, perhaps, when a large quantity of watery fluid is seen in the pleural cavities; when sand, seaweed, etc., is found in the bronchi, or even in the trachea; when the lungs are bulky or protrude on the removal of the sternum; and when the blood within the heart is wholly fluid,—especially when with these signs we find marked appearances of asphyxia in the heart, lungs, liver, etc.



